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First records of *Anisandrus maiche* Stark (Coleoptera: Curculionidae: Scolytinae) from North America

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Abstract

Anisandrus maiche Stark, an ambrosia beetle native to Asia, is reported for the first time in North America based on specimens from Pennsylvania, Ohio, and West Virginia. This is the twentieth species of exotic Xyleborina documented in North America. This species, along with three others occurring in North America, were formerly placed in *Xyleborus* Eichhoff, but currently are assigned to *Anisandrus* Ferrari. Descriptions of generic characters used to separate *Anisandrus* from *Xyleborus*, a re-description of the female *A. maiche*, and an illustrated key to the four North American species of *Anisandrus* are presented.

Key words: Coleoptera, Curculionidae, Scolytidae, Xyleborina, *Anisandrus maiche*, new North American record, exotic species

Introduction

Non-native bark and ambrosia beetles are being introduced and becoming established in North America at an ever-increasing rate. Ambrosia beetles in the Xyleborina are commonly transported and readily establish in new environments due to their cryptic nature and sib-mating behavior (Wood 1982, Atkinson *et al*. 1990). There are currently 40 species of Xyleborina north of Mexico, and 19 of these are non-native (Rabaglia *et al*. 2006; Hoebeke and Rabaglia, 2008). This paper reports the first occurrence of another non-native Xyleborina, *Anisandrus maiche* Stark, in North America, provides a key and description for its identification, and presents recent collection data.

During a US Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), Exotic Bark Beetle Survey, specimens of an unknown ambrosia beetle were collected in Moon Park, Allegheny County, Pennsylvania (26 May to 16 August 2005). Robert Androw, Carnegie Museum of Natural History (CMNH), first noticed the presence of this exotic species while processing trap samples under a contract with APHIS. Following the APHIS survey protocol, the suspect specimens were sent to APHIS Area Identifier, Frank Salantri who passed along a series of six specimens to the second author (NJV) at the US National Museum (USNM). Although the exotic nature of the species was easily confirmed, and its relation to another exotic, *Anisandrus dispar* (Fabricius), was correctly determined, the actual species identification was a collaborative effort between the first author (RJR) and NJV. Specimens were compared to a series in the RJR private collection identified as *Anisandrus maiche* by a Russian colleague, Michail Mandelshtam. Numerous additional specimens were collected in 2006 and 2007 by the third author (REA) in surveys by the USDA Forest Service in Pennsylvania, Ohio, and West Virginia.

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Materials and methods

The following acronyms have been used in this paper:

CMNH—Carnegie Museum of Natural History, Pittsburgh, PA
USNM—National Museum of Natural History, Smithsonian Institution, Washington, D.C.
SEL—USDA, Systematic Entomology Laboratory
APHIS—Animal and Plant Health Inspection Service

Authors' names are abbreviated in the text using their first, middle, and last initials.

All North American specimens of *A. maiche* were collected in Lindgren funnel traps baited with 95% ethanol, except the 2006 specimen from Beaver County, Pennsylvania and the specimen from Columbiana County, Ohio, which were collected in funnel traps baited with α- and β-pinene. North American records are given in a standard format as indicated in that section. Specimen determinations were made by the authors and confirmed by M. Mandelshtam (see Acknowledgements). Vouchers were deposited at USNM and CMNH. Morphological illustrations were created using Adobe Photoshop CS software and represent both redrawn and composite digital images.

Systematics

The Xyleborina (Xyleborini *sensu* Wood and Bright, 1992) is a large and complex group containing more than 1,200 species. An analysis of generic characters in the Xyleborina by Hulcr *et al.* (2007) resurrected several generic names, including *Anisandrus* Ferrari, which until recently has been treated as a synonym of *Xyleborus* Eichhoff by most taxonomists. Several North American species previously assigned to *Xyleborus* by Rabaglia *et al.* (2006) are now placed in the genus *Anisandrus*: *A. dispar* (Fabricius), *A. obesus* (LeConte) and *A. sayi* Hopkins. *Anisandrus maiche* is the fourth member of the genus presently known to occur in North America.

Anisandrus maiche Stark
(Figs. 1, 2, 4–6)

Anisandrus maiche Stark 1936: 142.
Anisandrus maiche Eggers 1942: 36 (Synonymy: Pfeffer 1944)

Diagnosis. Specimens of *A. maiche* can be distinguished from other members of *Anisandrus* occurring in North America by the smaller body size (< 2.5 mm), by the impressed 2nd declivital interstriae and striae, and the raised 3rd declivital interstriae with numerous distinct granules (Fig. 4). It is most similar to *A. dispar*, also a non-native species in North America, but is easily distinguished by its smaller body size (< 2.5 mm vs. > 3.2 mm for *A. dispar*), and the interstriae on the elytral disc which have only one row of seriate punctures (Fig. 2) compared with 2–3 rows of punctures in *A. dispar* (Fig. 3).

Distinguishing *Anisandrus* from other North American Xyleborina. Hulcr *et al.* (2007) restored the genus *Anisandrus*, and included species formerly in *Xyleborus*, *Ambrosiodmus* Hopkins and *Cyclorhipidion* Hagedorn. They state that *Anisandrus* belongs to a group of genera that are defined by a short, stout body, characteristically flattened antennal club, and, most importantly, the presence of a pronotal mycangial tuft of hairs (Fig. 1). *Anisandrus* is very similar to *Xylosandrus* except that the procoxae of *Anisandrus* are contiguous (Fig. 8), whereas those of *Xylosandrus* are separated (Fig. 7). In the key to species of *Xyleborus* north of Mexico by Rabaglia *et al.* (2006), species that are now recognized as species of *Anisandrus* are characterized by having the antennal club distinctly and obliquely truncate with segment 1 corneous (couplet

1), the anterior margin of the pronotum distinctly armed by several coarse serrations, and the body <2.2 x as long as wide (couplet 2) (Figs. 5, 6). The key is modified as follows to include *A. maiche* with alterations in bold type. An illustrated, online key (http://xyleborini.tamu.edu/keys.php) to North American Xyleborina will be updated to include *Anisandrus* in the generic key and the following key to the four species in North America.

Revised key to *Xyleborus* (including *Anisandrus*) in America north of Mexico

The following key, modified from the key to *Xyleborus* in Rabaglia *et al.* (2006), will permit the identification of the four species of *Anisandrus* found in North America.

3 (2). Posterolateral costa on declivity armed by 3–5 distinct tubercles (Fig. 24) ..... *A. OBESUS* LECONTE
- Posterolateral costa on declivity of uniform height, may appear undulating but without serrations **4a**

4a (3). Anterior margin of pronotum armed by 2–6 serrations, median pair conspicuously larger than others; declivity evenly convex, granules few and small; body length 2.5–2.7 mm ..... *A. SAYI* (HOPKINS)
- Anterior margin of pronotum armed by 6–8 subequal serrations; declivtal interstriae 1 slightly to conspicuously raised, granules numerous; body length <2.5 mm or > 3.2 mm 4b

4b (4a). Larger, body length 3.2–3.7 mm; declivital interstriae 1 slightly raised, 2 and 3 even; interstriae on elytral disc with 2–3 rows of seriate punctures ..... *A. DISPAR* (FABRICIUS)
- Smaller, body length 1.8–2.3 mm; declivital interstriae 1 raised, 2 impressed, 3 raised with numerous distinct granules; interstriae on elytral disc with 1 row of seriate punctures ..... *A. MAICHE* STARK

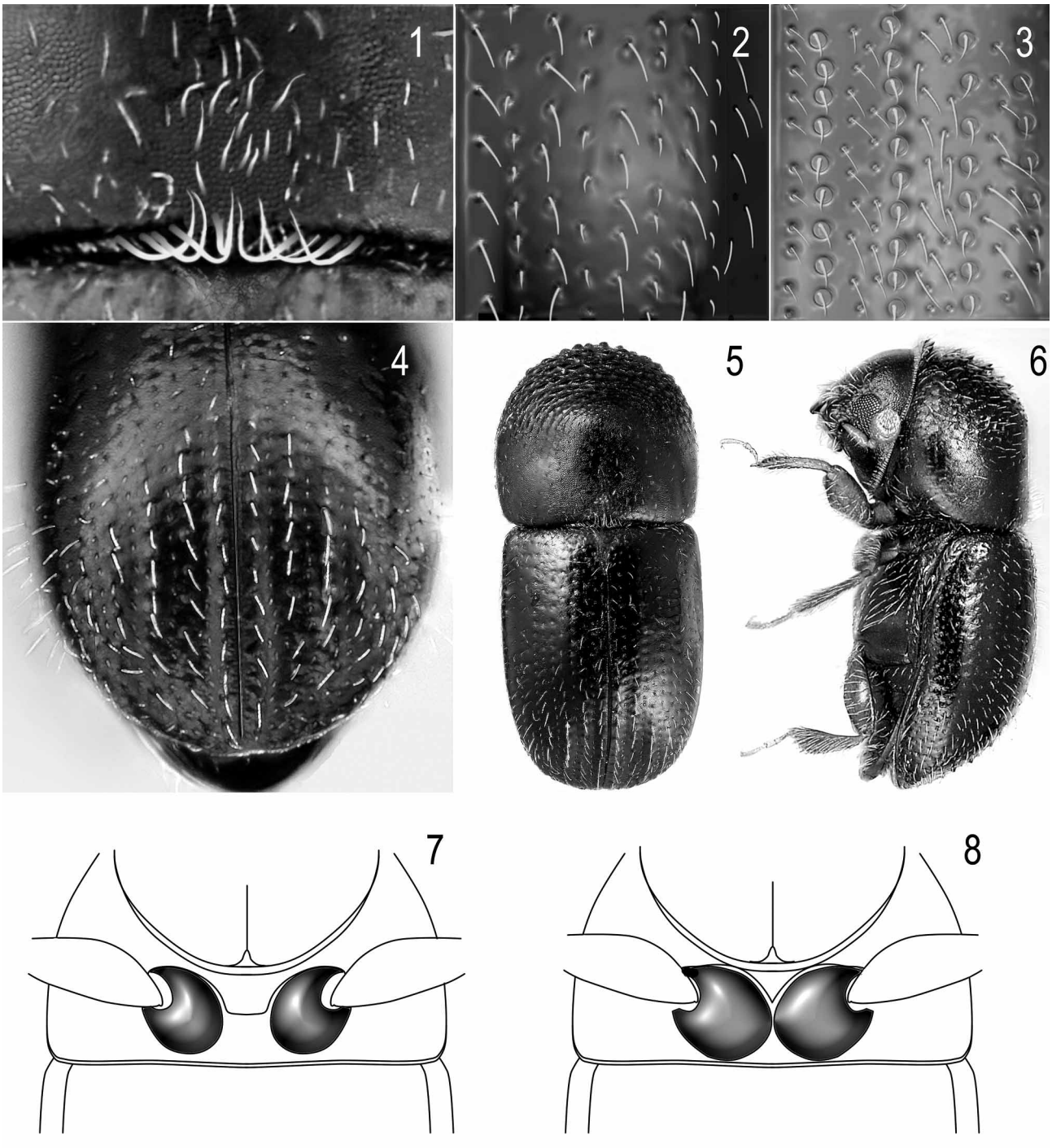
Description. Female. Length 1.8–2.3 mm, 2.3x as long as wide; color dark brown to black. Frons broadly convex, surface reticulate, punctures small, shallow, moderately close; vestiture inconspicuous, hairlike; antennal club type 1 or 2 *sensu* Hulcr *et al.* (2007), obliquely truncate, segment 1 corneous. Pronotum 1.1 times as wide as long; sides broadly rounded anteriorly; anterior margin armed by 6 to 8 coarse serrations; summit at middle; anterior half coarsely asperate; posterior area reticulate, punctures uniformly small; vestiture hairlike, short on disc, longer on anterior and lateral margins, forming tuft of short, dense setae at middle of posterior margin. Elytra 1.3 times as long as wide, 1.5 times as long as pronotum; sides straight; striae not impressed, punctures moderately coarse; interstriae smooth, about equal in width to striae, punctures very fine, in single row. Declivity, broadly convex, gradually sloping; interstria 1 elevated, striae 1 distinctly impressed, striae 2 impressed, interstria 3 slightly elevated; interstrial granules distinct especially on 3; posterolateral margin elevated, slightly sinuate or granulate. Vestiture of rows of very short strial setae and fine, long interstrial setae, in uniform rows, at least as long as interstriae.

Male. Not examined.

Distribution. China (Heilongjiang), Eastern Russia, Kunashiri Island (in South Kuril Islands), North Korea (Chu 1964, Krivolutskaya 1996, Krivolutskaya and Kupyanskaya 1970, Yanovskii 1999).

United States (all records new to North America): the locations have been arranged by county and state; numbers of specimens collected at each location are shown in parentheses after the date in the list below. PENNSYLVANIA**,** *Allegheny County*: Coraopolis, Moon Township Park, 26 May–10 June 2005 (11), 10–23 June 2005 (5), 23 June–5 July 2005 (9), 5–21 July 2005 (1), 2–16 August 2005 (3), 8–11 July 2006 (9); Etna, 13 June–28 July, 2007 (27); Pittsburgh, 13 June–28 July, 2007 (49); Elizabeth, 16 June–29 July, 2007 (8); Gibsonia, 19 June–3 August, 2007 (50); Bethel Park, 21 June–29 July, 2007 (378). *Beaver County*: Raccoon Creek State Park, 24 August 2006 (1); Fombell, 30 June–29 July, 2007 (4); Watts Mills, 14–29 July, 2007 (1). *Butler County*: Sarver, 30 June–14 July, 2007 (1). *Fayette County*: Masontown, 16 June–31 July, 2007 (64); New Geneva, 29 June–18 July, 2007 (1). *Greene County*: Garards Fort, 16 June–31 July, 2007 (9). *Indiana County*: Ernest, 3 July 2008 (2), 18 July 2008 (7), 15 August 2008 (2). *Lawrence County*: Wampum, 14 June–29 July, 2007 (13). *Washington County*: Claysville, 15 June–31 July, 2007 (10), Washington, 15 June–31 July, 2007 (168), Lone Pine, 15 June–31 July (80), Mingo Creek State Park, 6 August 2008 (6). *Westmoreland County*: Monessen, 16 June–28 July, 2007 (6). OHIO**,** *Jefferson County*: 14–30 June, 2007 (2). *Columbiana County*: Beaver Creek State Park, 19 August–5 September, 2008 (1). *Cuyahoga County:* Middleburg Heights,

6–22 June (30), 23 June–18 July, 2008 (10), 18 July–5 August (5). WEST VIRGINIA**,** *Brooke County*: Colliers, 30 June–14 July, 2007 (2). *Marshall County*: McMechen, 15 June–31 July 2007 (8).



FIGURES 1–8. Morphological illustrations of ambrosia beetles (subtribe Xyleborina): 1, *Anisandrus maiche* Stark, juncture of pronotum and elytron (dorsal view) showing pronotal mycangial tuft. 2, 3, detail of right elytral disk showing strial and interstrial punctures: 2, *A. maiche*; 3, *A. dispar* (Fabricius). 4, elytral declivity of *A. maiche*. 5, 6, habitus views of *A. maiche*: 5, dorsal view; 6 left lateral view. 7, 8, ventral view showing procoxae: 7, coxae well separated as in *Xylosandrus* spp.; 8, coxae contiguous, as in *Anisandrus* spp.

Biology, habits, and host

In its native Asian range, the known hosts for *A. maiche* are Aceraceae: *Acer* spp., *Acer barbinerve*, *Acer mandshuricum*; Betulaceae: *Alnus* spp., *Alnus fruticosa*, *Alnus hirsuta*, *Betula dahurica*, *Betula japonica*, *Corylus mandshurica*; Celastraceae*: Euonymus* sp; Oleaceae: *Fraxinus mandshurica*, *Syringa amurensis*; Magnoliaceae: *Magnolia* sp.; Rutaceae: *Phellodendron amurense*; Ulmaceae: *Ulmus* sp.; Juglandaceae: *Juglans mandshurica* (Krivolutskaya 1983, 1996, Stark 1952).

Although this species is certainly established in southwestern Pennsylvania and nearby Ohio and West Virginia, it has not been collected from any host trees. In a USDA Forest Service trapping survey in this area during June and July 2007, *A. maiche* was the third most abundant species collected, comprising 19% of nearly 5,000 specimens representing 29 species of scolytines.

It is difficult to predict the impact *A. maiche* will have in North America. *Anisandrus dispar*, a morphologically similar species introduced from Europe, is at times an important pest of fruit trees, especially in western North America (Wood 1982). Although many species of Xyleborina attack only weakened or unhealthy trees, some will attack newly transplanted seedlings or healthy trees with wounds or broken branches. All species carry symbiotic ambrosia fungi that are usually benign to hosts in their native range. However, as recently discovered with *Xyleborus glabratus* Eichhoff, another ambrosia beetle introduced from Asia, certain ambrosial fungi may prove to be very pathogenic on new, novel hosts in North America (Fraedrich *et al.* 2008).

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